Swinging the Compass - Capt Geoff

Part 3 – Using the azimuth (bearing) of the Sun

> Obligatory Caution: Use this process at your own risk. The Author of this article, Ripple Rock Squadron and Canadian Power and Sail Squadron take no responsibility for any navigational errors that may occur as a result of following this process.

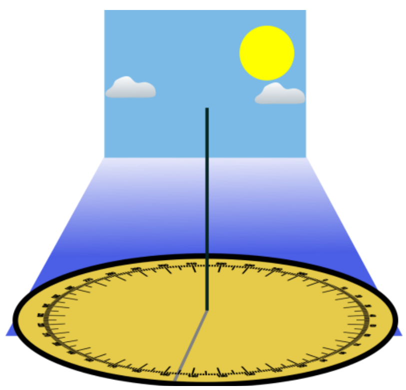
Please read Part 1 and Part 2 before reading this section. Part 1 provides and overview and an easy way to determine your Deviation (if you meet a few requirements). Part 2 explains swinging the compass with landmarks. This part replaces the landmarks with the Sun. Don't let the introduction of the Sun into the mix scare you. The actual azimuth (bearing) of the Sun can be found quite easily from a number of apps, or a US Government web page.

If you are offshore or unable to sight a good landmark, this method will give you the data you need to construct your deviation table. It works very much like the transit and GPS methods used in Part 2. (Part 1 is an overview and a simple method of swinging the compass that works in some situations.)

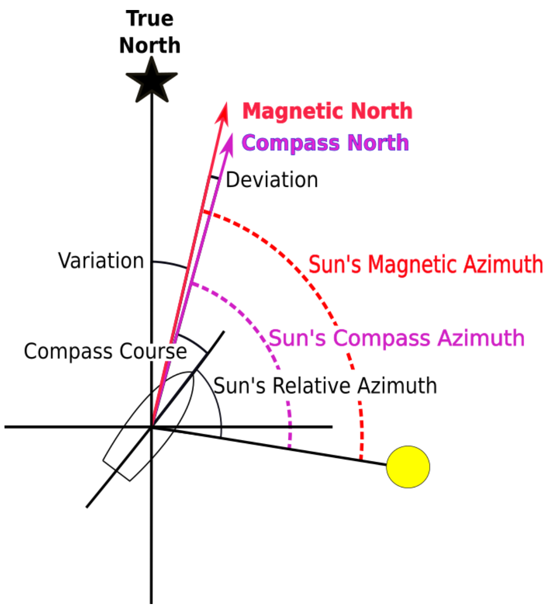
Applying the same principles used in Part 2, we simply shift from using our pelorus on a visual landmark to using the Sun.

Note that the position of the Sun (or other astronomical bodies) relative to us is is referred to in terms of azimuth and elevation, so instead of using the term bearing, we will use azimuth.

Because we can't look at the Sun, we use the pelorus sighting pin in its secondary mode, as a shadow pin. We have to convert the shadow azimuth to its reciprocal to find the actual azimuth.



Observing shadow azimuth of the sun.



For example, the reciprocal of 270 is found by subtracting 180, to give an azimuth of 090.

The illustration to the left shows all the factors involved with our calculations, making it a bit complicated at first glance. You can see that adding the relative azimuth of the Sun obtained by pelorus to our head at the time, we can quickly establish the compass bearing of the Sun.

We then look up the Sun's true bearing and correct for variation, giving us the Sun's magnetic azimuth.

The difference between the calculated magnetic azimuth and the Compass azimuth is the deviation for that Compass course.

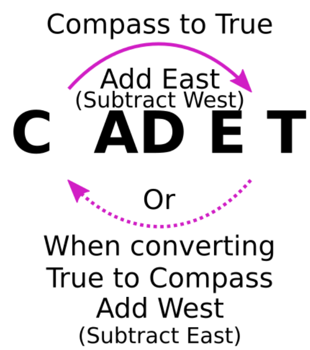
Here, you can see the data in TVMDC format (this is for a course/head of 030):

Sun's True Azimuth: Taken from web page or app.

Variation: Taken from chart, nearest compass rose. Updated to current year.

Magnetic Bearing: True bearing plus or minus Variation.

Use CADET mnemonic to decide whether to add or subtract Variation/Deviation.



Compass Bearing: Compass head (030) plus relative azimuth.

Relative azimuth of the Sun's shadow was 220. Subtract 180 to find actual azimuth of 040. (To make the math easier, I would subtract 200, then add 20.)

T	V	M	D	C
092	17E	075		070

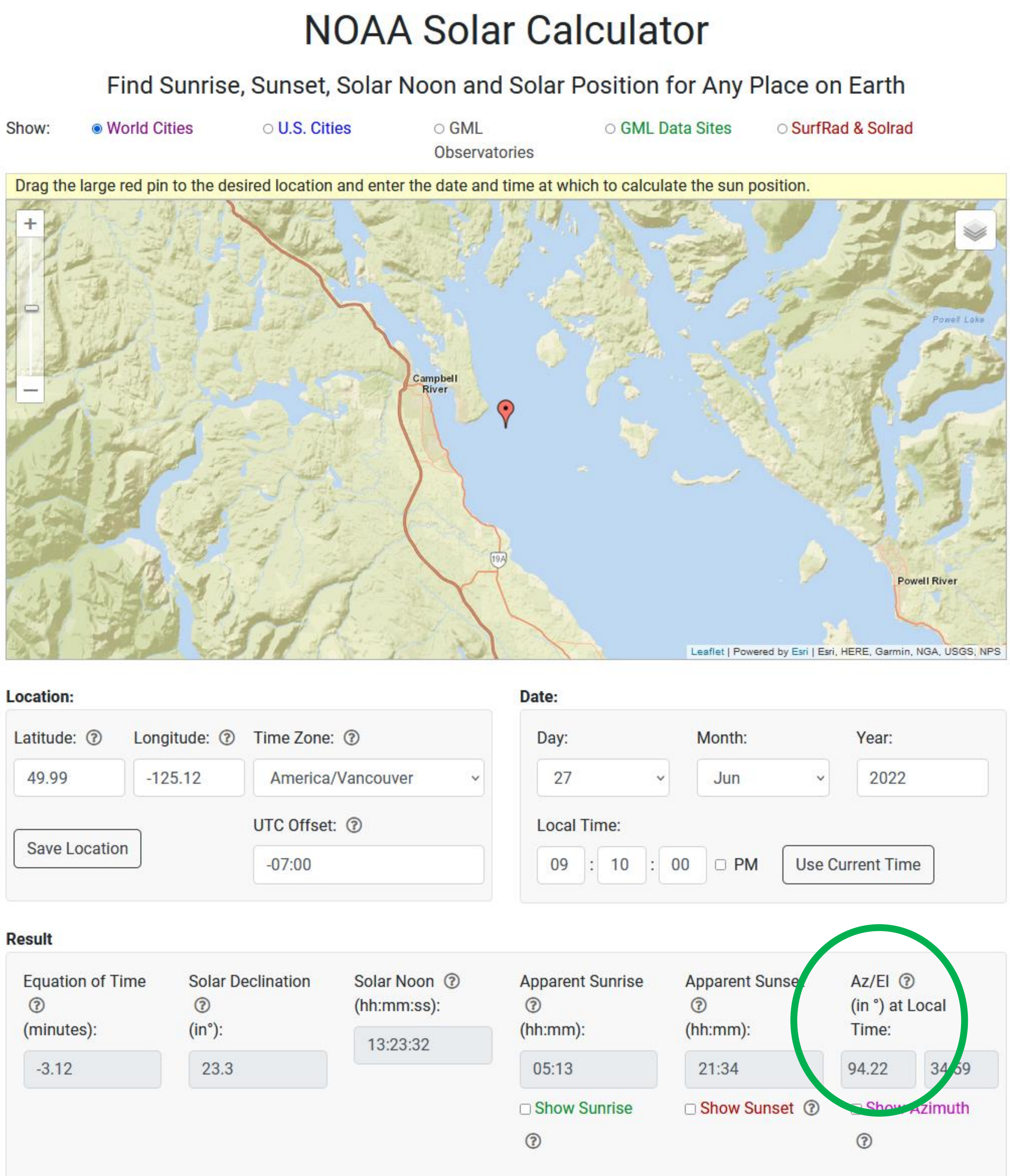
To find the true azimuth of the sun for an app or webpage requires our position and the date and time the azimuth was taken. Because the Sun's azimuth changes continuously, we need to record the time for each azimuth of our swing. Making a circle at slow speed should keep our position fairly constant, but you will need to record the position to use either an app or the web page.

Similar to Part 2, we can create a TVMDC based table for each 30 degree heading. Because we must track the change in the Sun's azimuth I have added a time column to this table as well as our position, which we would take from our GPS (or from being very close to a known position).

Date: June 27, 2022				Lat: 49.99		Lon: -125.12	
Time	True Azimuth	Variation	Magnetic Azimuth	Deviation	Compass Azimuth	Relative Azimuth	Compass Head
0900	092	17E	075	3 E	072	072	0
0901	092	17E	075	5 E	070	040	30
0902	093	17E	076	3 E	073	013	60
0903	093	17E	076	0	076	346	90
0904	093	17E	076	2 W	078	318	120
0905	093	17E	076	4 W	080	290	150
0906	093	17E	076	4 W	080	260	180
0907	094	17E	077	3 W	080	230	210
0908	094	17E	077	1 W	078	198	240
0909	094	17E	077	0	077	167	270
0910	094	17E	077	1 E	076	136	300

From this data we can create our deviation card as we did in part 1 and 2.

As noted there are several ways to get the sun's true azimuth. The screenshot below if from the US NOAA Solar Calculator at https://gml.noaa.gov/grad/solcalc/



This calculator allows you to drag the red marker to your position, or input lat and lon directly.

The direct latitude and longitude (lat/lon) entry uses degrees and fractions of degrees, so if you are using the common degrees and minutes format, you will have to divide the minutes of your position by 60 to get the fraction (or switch your GPS/Charting display to degree and decimal format). Also, when using this format, West Longitude is a negative value. (If you look at raw GPS position data – as seen in GPX or KML format – it also uses a minus sign for West Longitude). In my experiments, two decimal places seemed to give adequate accuracy. The Azimuth for this date/time and position is 94.22, which rounds to 094.

For the swing, do a small circle at slow speed to minimize position change, and record that position. For each measurement, record relative bearing and time taken. You can then enter the data in the "Solar Calculator" to compete the True Azimuth column. Then, as with the transit method (part 2), apply variation to determine Magnetic Azimuth. Again, as with the transit method, combine Relative Azimuth and Compass Head to find Compass Azimuth, leaving only Deviation to be calculated.

Hopefully this series of articles has helped you create a Deviation card for your boat that will give you confidence to use your compass. Electronics are fine assistants, but they tend to fail at critical times. Having a reliable compass gives you one more tool to keep you safer.

Again, if the concepts of Variation, Deviation as well as True, Magnetic and Compass courses are new to you, you may want to consider taking a boating course. Going beyond the basics covered in the PCOC, Ripple Rock Squadron offers Canadian Power Squadron's Boating 2 & 3, a more advanced course, which we tailor to boaters around Campbell River. Check us out at http://www.ripplerocksquadron.com/